Readout of an antiferromagnetic spintronics system by strong exchange coupling

November 26 2021

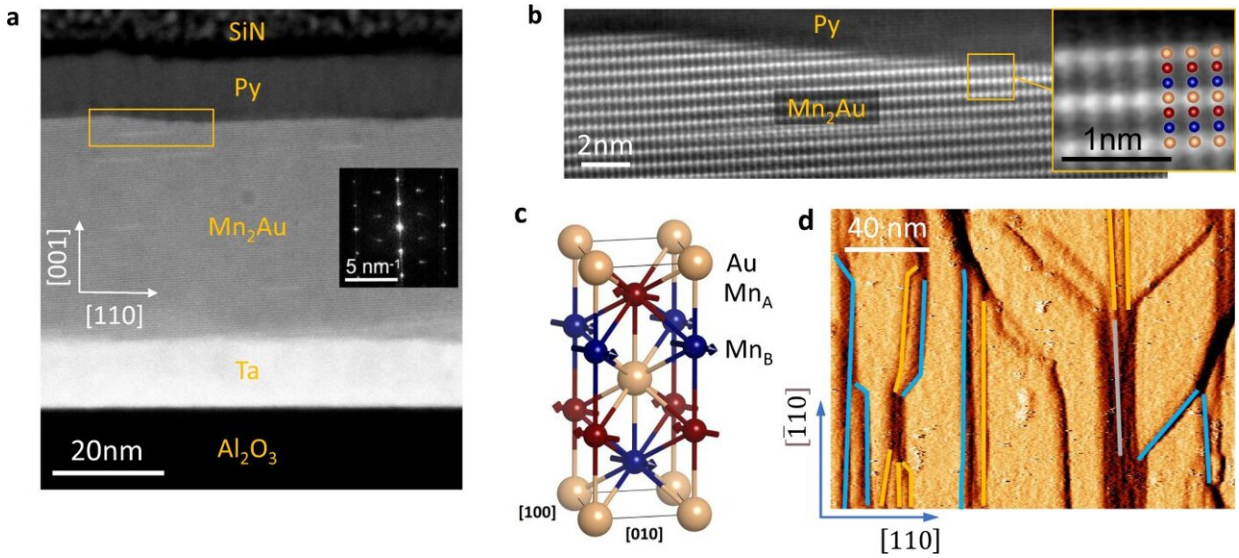

Fig. 1: Structure of the samples. a Cross section HAADF STEM image of the entire stack viewed along the [1⁻10]-direction of Mn_2Au(001). The inset shows a local Fourier transform of the Mn_2Au region. b Magnified image of the Mn_2Au/Py interface (region indicated by a rectangle in a), where Au atom columns have bright contrast. The inset shows a higher magnification image overlaid with a model of the crystal structure. c Crystal structure of Mn_2Au with the magnetic moments pointing along the easy [1⁻10]-direction. d STM image of a pristine Mn_2Au(001) thin film surface with steps corresponding to half unit cells (0.42 nm) indicated by the yellow lines, one unit cell (0.85 nm) indicated by the blue lines, and three unit cells (2.55 nm) indicated by the gray line. Credit: DOI: 10.1038/s41467-021-26892-7

Within spin-based electronics (spintronics), a novel approach promising ultrafast and stable magnetic memory is based on antiferromagnets as active elements. These materials without macroscopic magnetization but with a staggered orientation of their microscopic magnetic moments display intrinsic dynamics in the Terahertz (THz) range and are robust against magnetic fields.

However, technologically relevant read-out in spintronics requires significant magnetoresistance effects, i.e., resistance changes larger than 20 percent should be associated with a reorientation of the staggered magnetization. This represents a major challenge in antiferromagnetic spintronics.

New approach enables the well-established read-out methods of ferromagnets

As published in the online science journal *Nature Communications*, scientists of the Institute of Physics of Johannes Gutenberg University Mainz (JGU), within an international collaboration, are now able to demonstrate a strong exchange coupling of very thin ferromagnetic layers to the prototypical antiferromagnetic spintronics compound of manganese and gold (Mn2Au). This allows us to benefit from the well-established read-out methods of ferromagnets, while the essential advantages of antiferromagnetic spintronics are only slightly diminished.

More information: S. P. Bommanaboyena et al, Readout of an antiferromagnetic spintronics system by strong exchange coupling of Mn2Au and Permalloy, *Nature Communications* (2021). DOI: 10.1038/s41467-021-26892-7

Provided by Universitaet Mainz